

PM10 EXCEPTIONAL EVENT
NOVEMBER 14, 2006
MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

ADDENDUM TO DISTRICT NATURAL EVENT DOCUMENTATION

This report is an addendum to the Natural Event Documentation (NED) for the Victorville monitoring station prepared by the Mojave Desert Air Quality Management District (District). The District documentation was submitted to the California Air Resources Board (ARB) on June 28, 2007, and supplemented in September 28, 2007 and March 3, 2008. This report demonstrates that without this natural high wind event, there would not have been exceedances of the federal PM10 Standard on November 14, 2006.

The Code of Federal Regulations (CFR) provides the definition and criteria for determining whether air quality data is impacted by an exceptional event. The 40 CFR 50.1 (j) definition states that “exceptional event means an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event.” The demonstration to justify data exclusion as outlined in 40 CFR 50.14 specifies that evidence must be provided that:

1. The event meets the definition of an exceptional event;
2. There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected air quality in the area;
3. The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and,
4. There would have been no exceedance or violation but for the event.

This report documents that the event meets the above criteria and provides analysis to demonstrate that:

- I. The dust event was not reasonably controllable or preventable because the PM10 originated from a non-anthropogenic source;
- II. There is a clear-causal connection between the high wind event and the exceedance at Victorville;
- III. The measured concentration was beyond normal historical levels; and
- IV. The exceedance would not have occurred “but for” the high winds.

Overview of Event

On November 14, 2006, strong wind gusts over the Mojave Desert Air Quality Management District entrained dust into the atmosphere, causing PM10 exceedances at the Victorville monitor. Anthropogenic sources near the monitor played only a small role in the PM10 levels seen at this site. The District has reasonable and appropriate controls in place to reduce dust from anthropogenic sources. The winds on this day,

however, were high enough to overwhelm any control measures. Therefore, this natural event and the associated exceedance was not reasonably controllable or preventable.

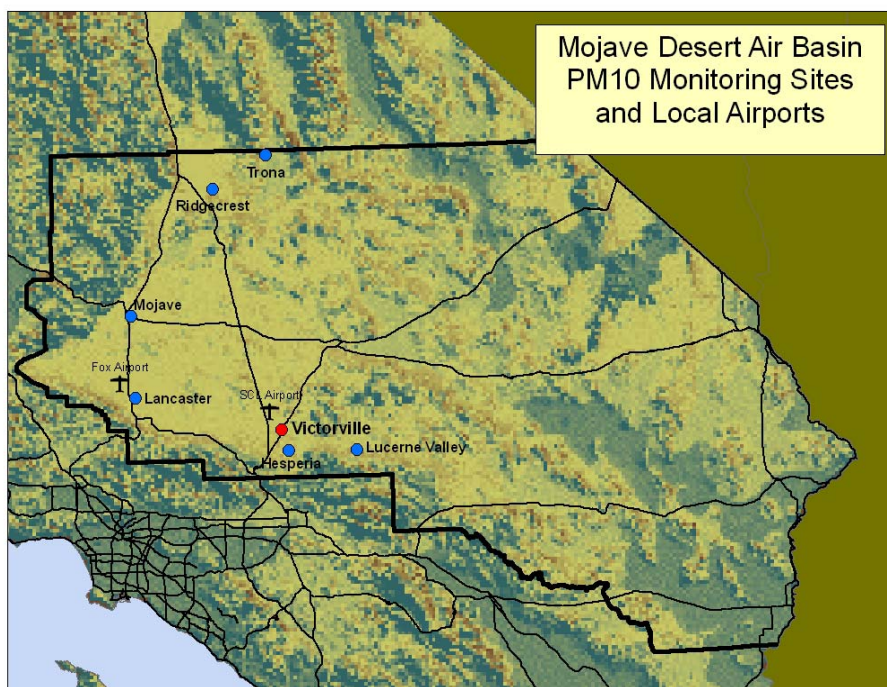
Affected Air Quality

On November 14, 2006, the Federal Equivalent Method (FEM) TEOM (Tapered Element Oscillating Microbalance) monitor at Victorville in the Mojave Desert Air Quality Management District (District) recorded a concentration of $167.8 \mu\text{g}/\text{m}^3$, exceeding the National Ambient Air Quality Standard (NAAQS) of $150 \mu\text{g}/\text{m}^3$. This was not a scheduled monitoring day for the Federal Reference Method (FRM) monitors and the only other TEOM operating in the District was Trona (80 miles to the north), which did not show any elevation in PM10.

Table 1. Mojave Desert PM10 monitoring sites and Concentrations – 11/13/06-11/15/06

Site	Monitor	AQS No.	PM10 Concentration ($\mu\text{g}/\text{m}^3$)			
			11/12/06	11/13/06	11/14/06	11/15/06
Victorville	FRM	60710306		47		
Victorville	TEOM	60710306	21.9	50.2	167.8	21.6
Trona	FRM	60711234		13		
Trona	TEOM	60711234	6*	16.9*	21.6	19.4
Ridgecrest	FRM	60290015		23		
Mojave-Poole	FRM	60290011		14		
Lucerne Valley	FRM	60710013		25		
Lancaster	FRM	60379033		19		
Hesperia	FRM	60714001		52		
			* 15 (or less) hours of data			

Figure 1. Mojave Desert PM10 monitoring sites and airports

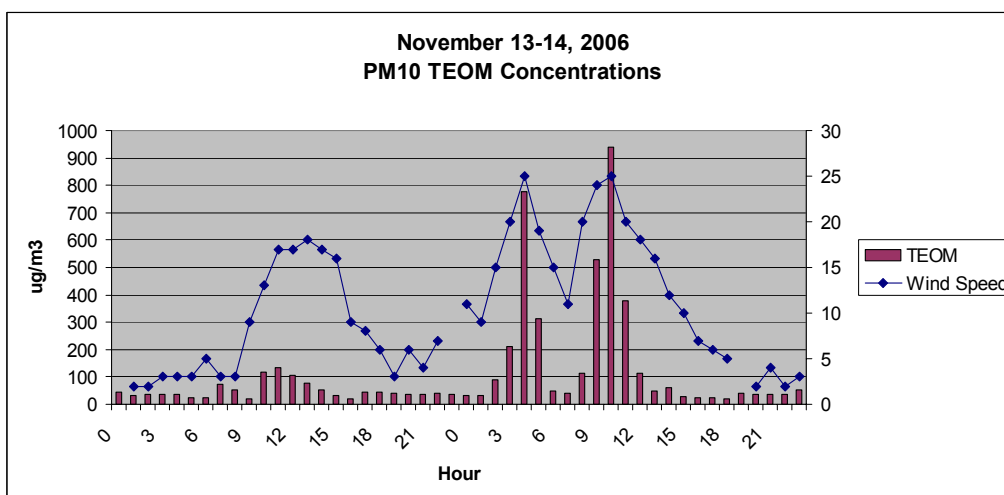


Clear Causal Connection

Hourly winds, which began to increase on November 13 at the District and Air Resources Board (ARB) monitoring sites (Appendix A in the District NED) gusted as high as 40 mph at the Victorville (SCL) Airport on November 14. These winds were primarily from the desert areas to the west/northwest of the monitoring site.

PM10 concentrations (Figure 2) at the Victorville TEOM monitor showed a slight increase on November 13, corresponding to an increase in surface wind speeds. The highest PM concentrations, when hourly values of over 700 $\mu\text{g}/\text{m}^3$ resulted in the PM10 NAAQS exceedance, occurred with the highest wind speeds on November 14. Both wind speeds and PM concentrations had decreased by the next day, November 15, returning to levels seen before the event.

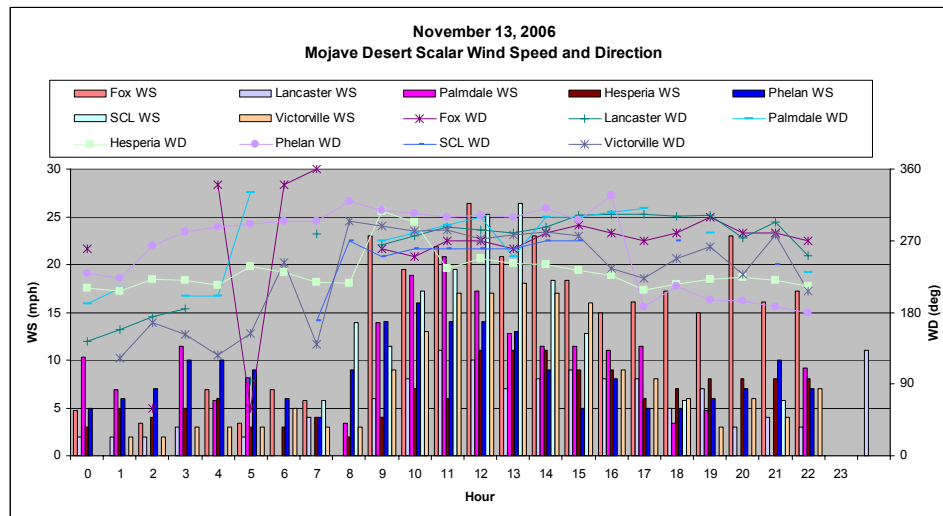
Figure 2. PM10 TEOM Concentrations and Wind Speeds at Victorville – November 13-14, 2006.



November 13

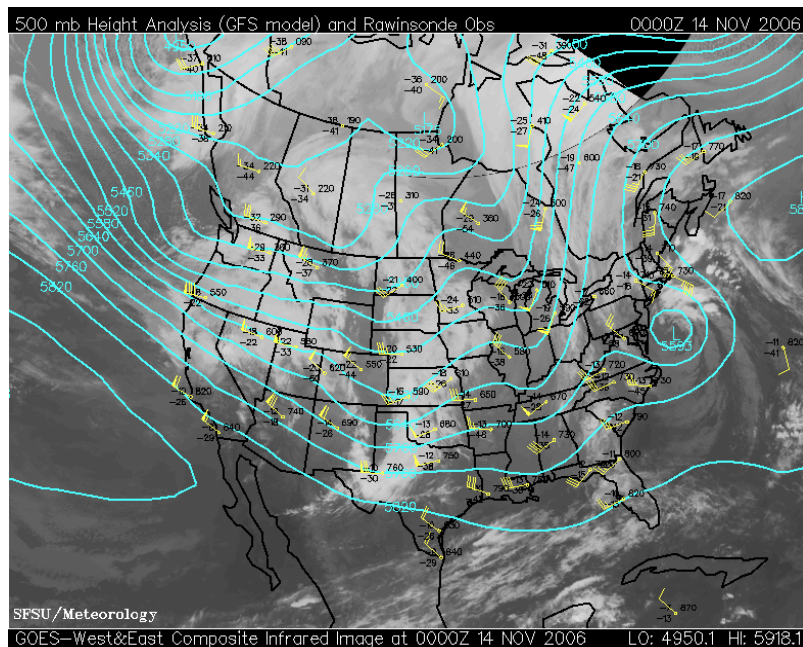
Hourly average data (Figure 3) from District monitoring sites shows wind speed throughout the region increased substantially in the morning of November 13; at the same time, wind direction shifted to an almost regionally uniform westerly flow. Hourly averages reached as high as 26 mph at the Fox and SCL Airports, well above the regional dust entrainment thresholds of 15 mph in Imperial County (ENVIRON, 2004) to the south and 18 mph in the San Joaquin Valley (Bush, 2004; 73 FR 14696) to the north.

Figure 3 – Hourly Average Wind Speeds and Directions at District Monitoring Sites



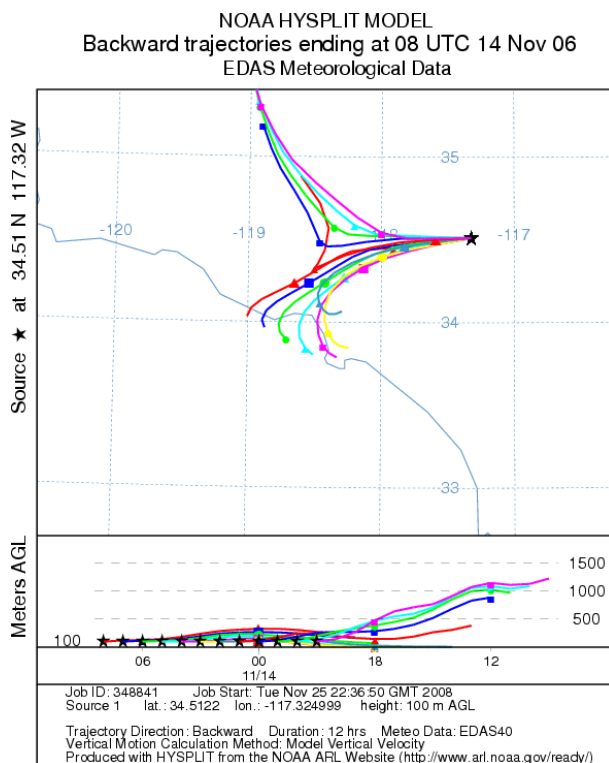
Satellite data on November 13 (Figure 4), shows strong airflow in the upper atmosphere from the west and northwest, supporting the surface pattern flow and allowing the entrained dust to be transported to the Victorville air monitoring site in the Mojave Desert.

Figure 4: Upper Atmosphere Wind Flow
Satellite GOES West/East Composite IR - 500 mb level
00Z 111406 (4p.m. PST 111306)



Backward trajectories, using NOAA's HYSPLIT model, corroborate the strong western flow. Figure 5 shows air parcels originating west of the region and impacting the Victorville site from noon to midnight on November 13.

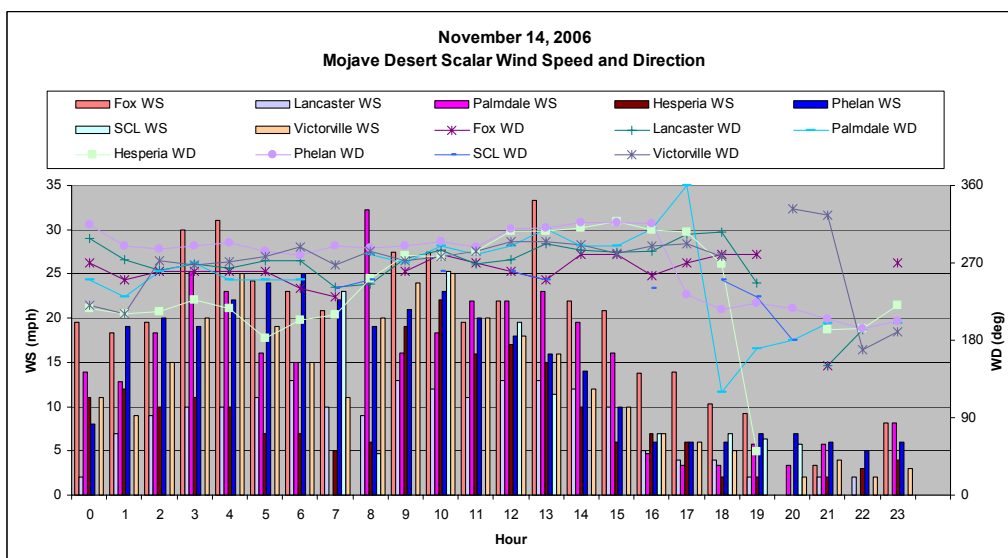
Figure 5. NOAA HYSPLIT backward trajectories – noon to midnight, 11/13/06.



November 14

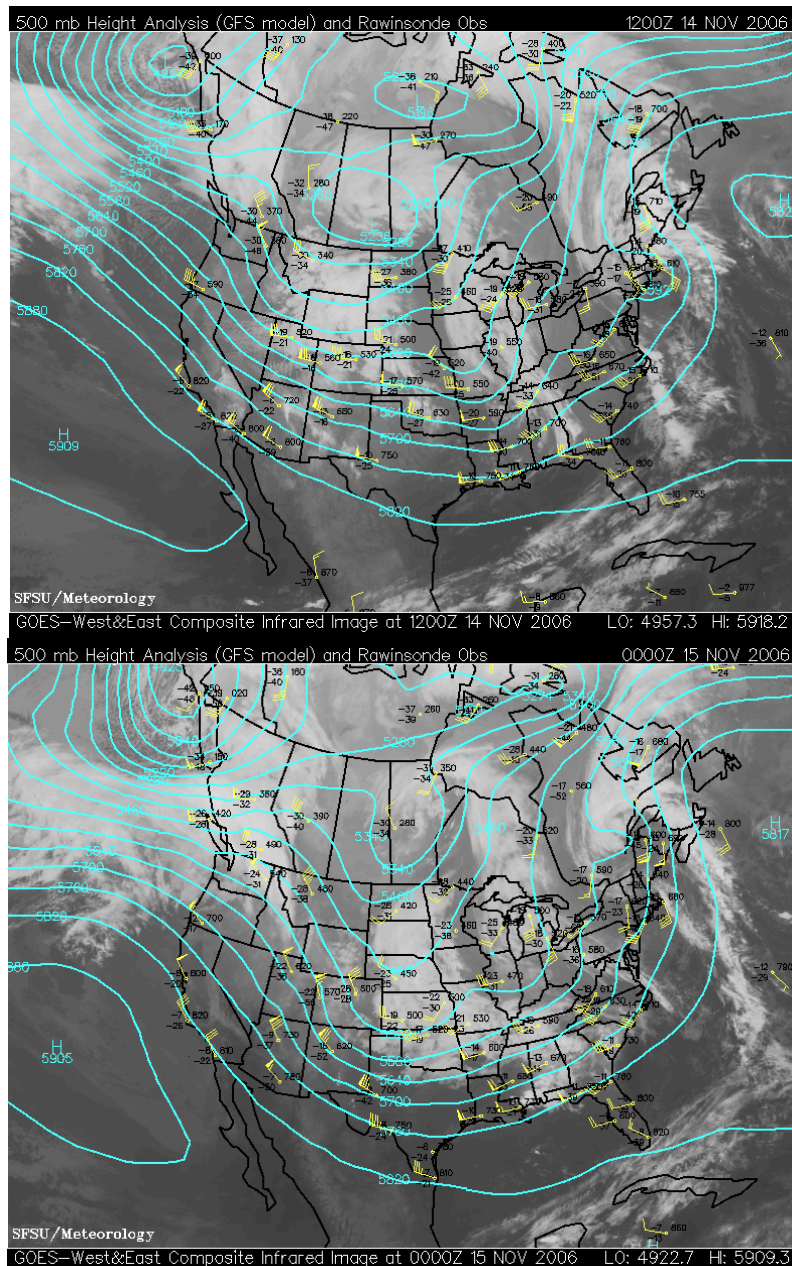
The high winds of the 13th continued into the next day (Figure 6), decreasing in the afternoon followed by a break down of the uniformity of the western flow. PM concentrations, shown in Figure 2 above, decreased to below NAAQS levels with the decrease in wind speed.

Figure 6 – Hourly Average Wind Speeds and Directions at District Monitoring Sites



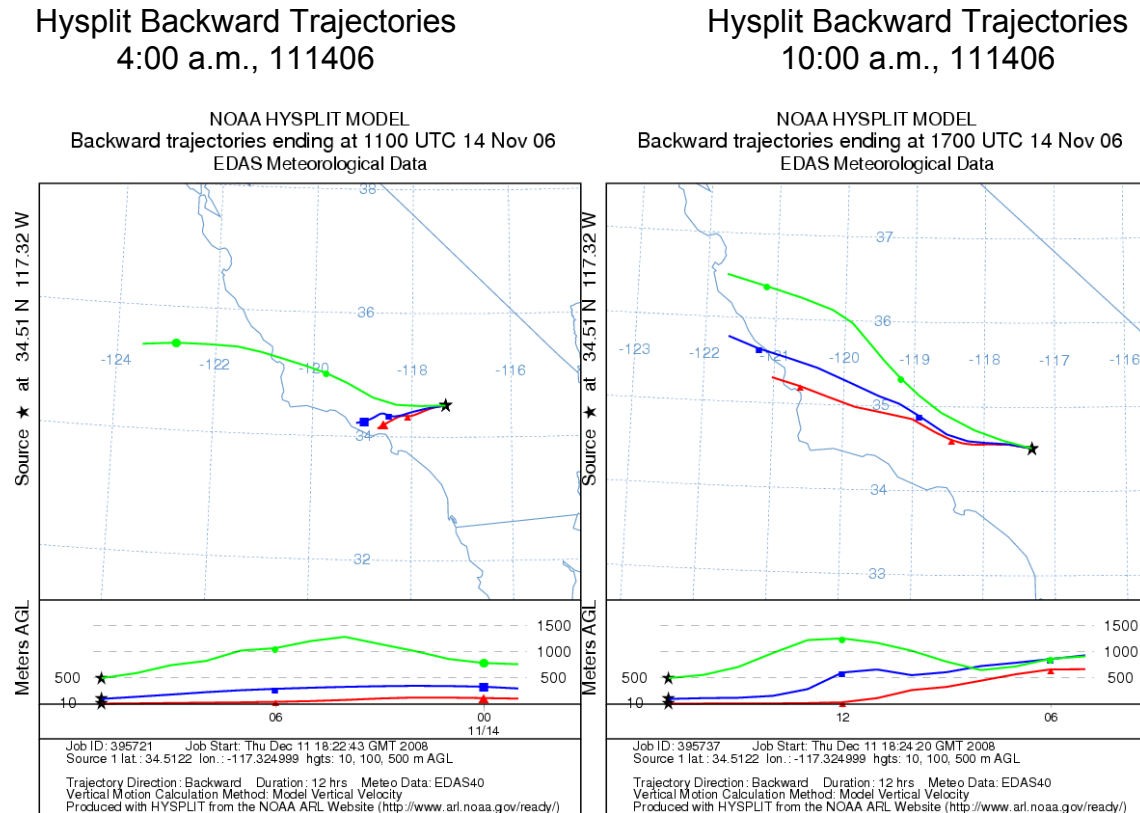
The satellite image (Figure 7) of the morning of November 14, shows strong airflow in the upper atmosphere from the west and northwest, supporting the surface flow pattern. Later in the day (4 p.m.), the satellite view shows a slightly more northern component to the upper air flow and the station monitors corroborate the lower wind speeds already noted at the monitoring site.

Figure 7: Upper Atmosphere Wind Flow
 Satellite GOES West/East Composite IR - 500 mb level
 Top: 12Z 111406 (4 a.m. PST 111406)
 Bottom: 00Z 111406 (4 p.m. PST 111406)



Hysplit backward trajectory models indicate a western impact at Victorville at both 4:00 a.m. and 10:00 a.m. on November 14, the hours of the peak PM10 concentrations.

Figure 8. NOAA HYSPLIT backward trajectories for November 14, 2006.



Above Historical and Background Levels

Wind Speed

Historically, the predominant wind at Lucerne Valley, located 24 miles ESE of Victorville, is from the west-northwest at around 10 mph (around 60% of the time). In the fall and winter, these winds fall to approximately 8 mph. The annual resultant winds are from the west/northwest at approximately 5 mph, with those in the fall and winter coming from the same direction at less than 4 mph [CARB, 1984]. On November 14, winds were from the expected west/northwest direction, but hourly average speeds were considerably higher than seasonal predominant or resultant winds, ranging up to 25 mph, with gusts of up to 42 mph. These speeds were well above both background levels and historical fluctuations.

Maximum wind speeds at the Victorville monitoring site (Table 2) showed November mean daily maximum wind speeds of 11 mph (12 mph for 2006). A standard deviation of the combined data was 5.05. The number of days with high winds is shown in Table 3. The only November day that exceeded the NAAQS since 2003 was November 14, 2006.

As illustrated in Figure 9, the maximum wind speed at Victorville on that day (not including wind gusts noted at the nearby SCL Airport) was almost three standard

deviations above the November historical average, making it clearly an exceptional event.

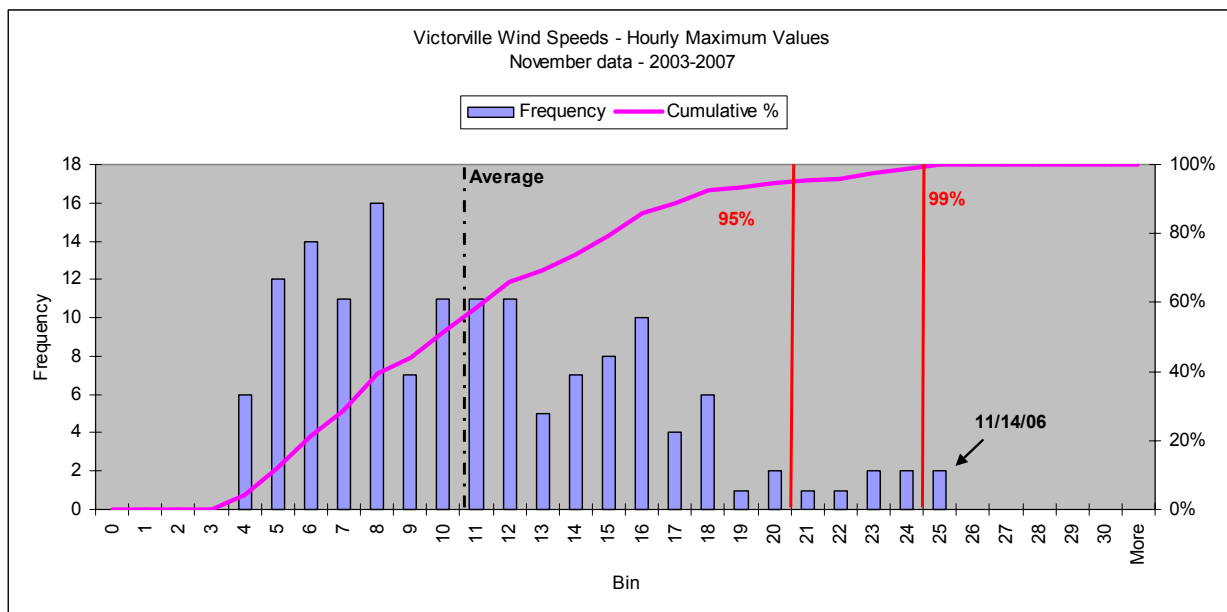
Table 2. November Daily Maximum Wind Speed Statistics for Victorville

	2003-2007	2003	2004	2005	2006	2007
Mean	11.09333	11.33333	11.5	11.33333	11.9	9.4
Standard Error	0.412809	0.887115	0.88246	1.117606	0.959346	0.715349
Median	10	10.5	11	8	10.5	9
Mode	8	10	6	6	8	12
Standard Deviation	5.055858	4.858929	4.833432	6.121378	5.254555	3.918128

Table 3. November Maximum Wind Speeds and PM10 TEOM Concentrations (2003-2007).

Wind Speed (mph)	No. of Days	PM10 range
15-17	22	8-76
18-20	8	16-50
21-23	4	18-83
24-26	4	16-168*
		*11/14/06 was only exceedance

Figure 9. Historic Maximum Daily Wind Speeds, Victorville, November 2003-2007



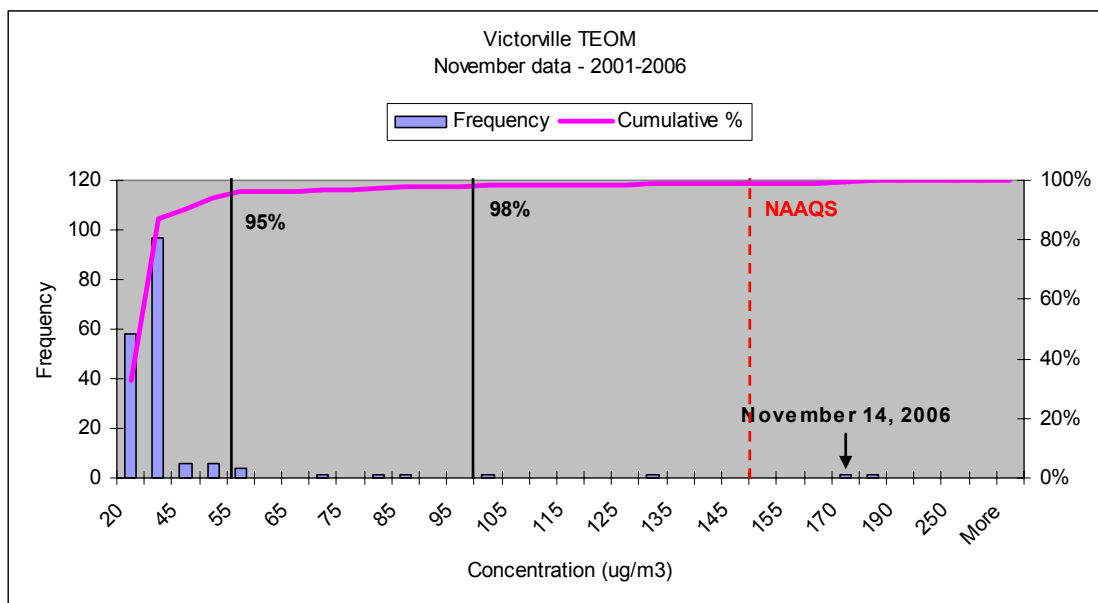
Air Quality

PM concentrations at the Victorville site in November are generally well below the NAAQS (Table 4). As shown in Figure 10, exceedances like the one seen at the TEOM monitoring site on November 14 occur less than 1% of the time. The concentrations were far above historical fluctuations as well as above background levels. The only other time the PM₁₀ TEOM concentrations exceeded the NAAQS in November was November 22, 2001. On that day, winds at the Fox Airport averaged 32 mph, peaked at 47 mph, and were also predominantly from the west. Wind at the monitoring site averaged 17 mph, peaking at 31 mph. No wind direction was recorded [CARB, AQMIS2, 2008].

Table 4. November PM₁₀ Statistics for Victorville

	<i>Victorville FRM (all sites)</i>	<i>Victorville TEOM (Park site)</i>
Data Range	1986-2007	2001-2006
Count	81	178
Mean	33.81	29.66
Standard Error	1.65	1.62
Median	33.00	26.33
Mode	21.00	18.54
Standard Deviation	14.81	21.57

Figure 10. Historical November PM₁₀ TEOM Concentrations at Victorville



No exceedance ‘but-for’ the Event

An estimation of the PM10 mass contributed by the high wind event to the concentration seen at the monitor is given in Table 5. The upper range of a normal concentration for November would have been between 29 and 83 ug/m3. Following U.S. Environmental Protection Agency guidance (U.S.EPA, 2009), ARB Staff estimates that the high wind event on November 14, 2006 provided an additional 85 to 142 ug/m3 of PM10. ‘But-For’ the high wind speeds and shift in wind direction and associated hourly PM10 levels, there would have been no exceedance of the federal PM10 standard.

Table 5. Estimate of PM10 Concentration ‘But-For’ the Event

Event Day Concentration	November Average (2001-2006)	November 98th Percentile	Estimated Contribution of Event
168 ug/m3	29 ug/m3	83 ug/m3	85 - 139 ug/m3

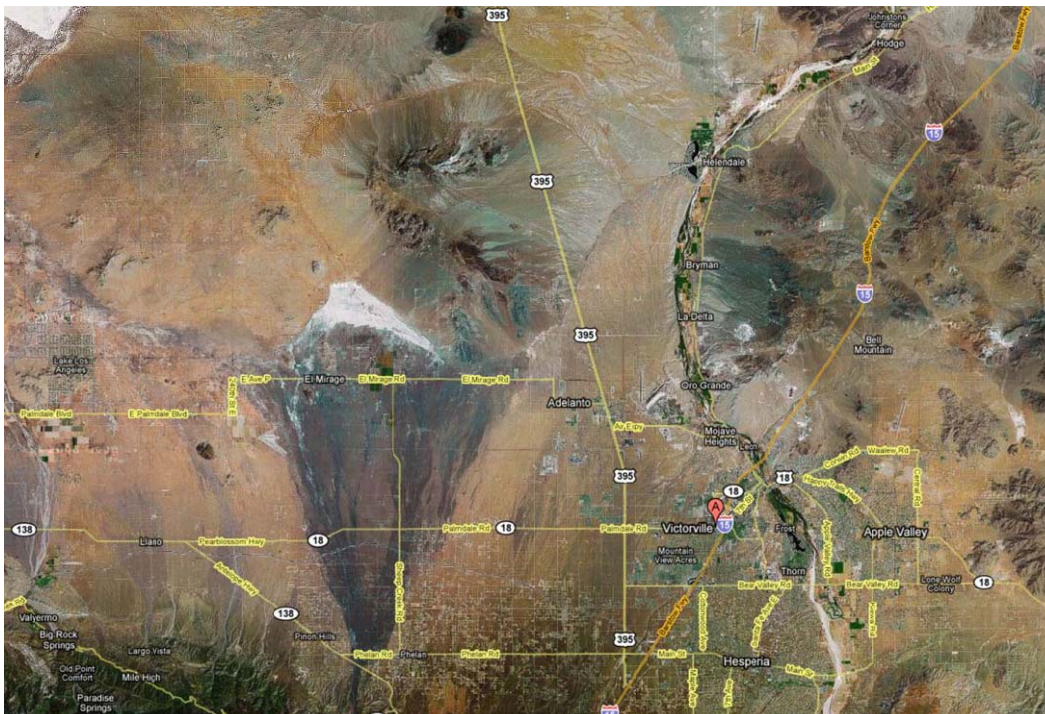
PM Concentrations at the Mojave Desert air quality monitoring sites are generally well below the NAAQS. As noted in the NED, exceedances at the Victorville TEOM like the one on November 14 occurred only seven times from February, 2000 to April 2007 (less than 1% of the time). The November 14 concentration was far above historical fluctuations as well as above background levels.

Determination of Source of PM10 in Area

Victorville is located in the portion of the Mojave Desert known as Victor Valley. The area immediately to the west of Victorville (Figure 11) is mixed desert with some suburban housing and commercial development along Interstate 395. Further west, the area is considered unincorporated land with a scattering of homes, but still mostly desert. The El Mirage Dry Lake is northwest of the Victorville monitoring site.

The winds that impacted the monitoring site flowed over the western desert areas at speeds high enough to both entrain and transport dust. Dust control measures for the Mojave Desert were in effect on November 13 and 14, but were overwhelmed by these high winds.

Figure 11. Satellite image – Western Mojave Desert (maps.google.com)



The PM10 emissions inventory was reviewed to determine local sources that could generate dust and potentially contribute to the PM10 exceedance. The 2006 PM10 emissions inventory is summarized in Table 6. This inventory portrays annual average emissions and does not directly reflect emissions during an exceptional event.

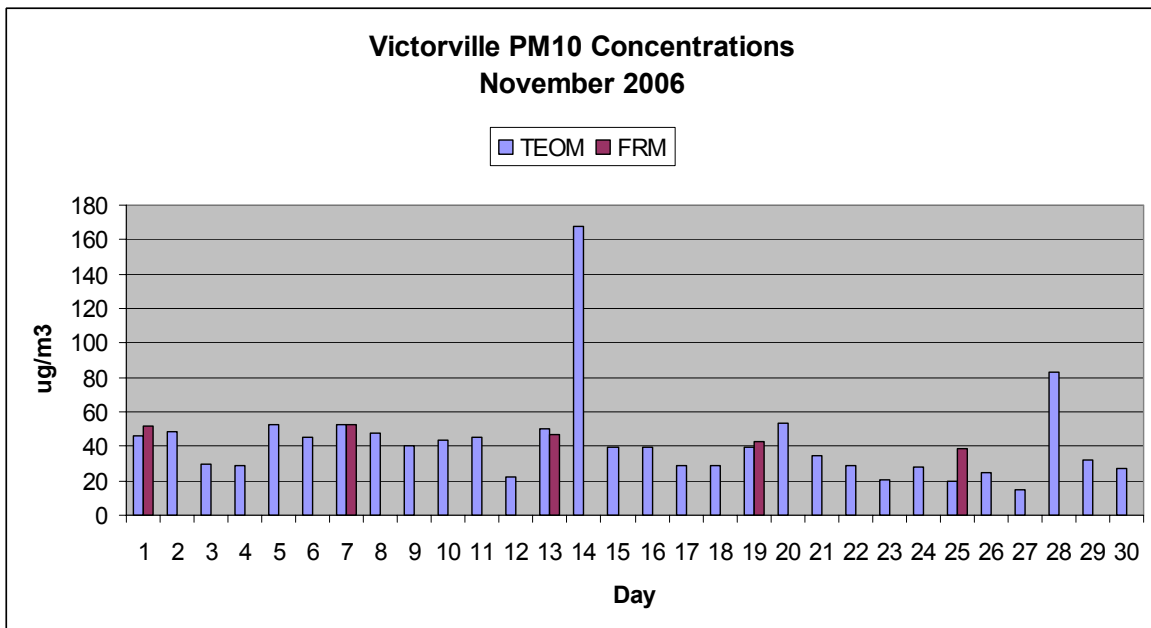
As noted below, the majority of PM10 emissions in the area are from area-wide sources, in particular, road dust (paved and unpaved) and fugitive windblown dust. The MDAQMD adopted Rule 403.2, Fugitive Dust Control for the Mojave Desert, in 1996 as a Reasonably Available Control Measure (RACM). These measures specifically address emissions from construction activities, unpaved roads, and activities on Bureau of Land Management lands. Unfortunately, no measure can control all dust if wind speeds reach a level high enough for entrainment and transport. Hourly averaged scalar wind speeds at Victorville and surrounding areas met or exceeded the entrainment threshold of 15 mph for five hours on November 13 and 11 hours on November 14, with gusts at the SCL Airport reaching as high as 40 mph (see Figures 2, 3, and 6 in this document, and the NED appendices).

Table 6. 2006 Annual Average PM10 Emission Inventory for San Bernardino County portion of Mojave Desert Air Basin (TPD)

STATIONARY SOURCES	
SUMMARY CATEGORY NAME	2006
FUEL COMBUSTION	0.573
WASTE DISPOSAL	0.005
CLEANING AND SURFACE COATINGS	0.019
PETROLEUM PRODUCTION AND MARKETING	0.001
INDUSTRIAL PROCESSES	11.469
** TOTAL STATIONARY SOURCES	12.066
AREAWIDE SOURCES	
SUMMARY CATEGORY NAME	2006
SOLVENT EVAPORATION	0.000
MISCELLANEOUS PROCESSES	
RESIDENTIAL FUEL COMBUSTION	1.522
FARMING OPERATIONS	0.122
CONSTRUCTION AND DEMOLITION	7.701
PAVED ROAD DUST	9.880
UNPAVED ROAD DUST	34.084
FUGITIVE WINDBLOWN DUST	15.070
FIRES	0.020
MANAGED BURNING AND DISPOSAL	0.453
COOKING	1.795
* TOTAL MISCELLANEOUS PROCESSES	70.646
** TOTAL AREAWIDE SOURCES	70.646
MOBILE SOURCES	
SUMMARY CATEGORY NAME	2006
ON-ROAD MOTOR VEHICLES	4.521
OTHER MOBILE SOURCES	1.293
** TOTAL MOBILE SOURCES	5.814
TOTAL MOJAVE DESERT AQMD IN SAN BERNARDINO COUNTY	88.526

Additional documentation, submitted by the District to U.S. EPA on March 3, 2008, noted that the event was not related to local anthropogenic or non-compliant emission sources. No changes in emission patterns before, during, or after the event occurred which would account for the increased concentrations. As noted in Figure 12 below, PM10 concentrations at Victorville remained fairly consistent throughout the month and were well below the level of the standard.

Figure 12. PM10 Daily Concentrations – Victorville, November 2006



Mitigation Requirements

Provide for Prompt Public Notification of Exceedance Events

As noted in the NED, a Health Advisory Program exists to notify the public, via website postings and news media releases, of unhealthy air quality events. The District operates four PM10 TEOM sites for forecasting purposes. This data is utilized by the Mojave Desert AQMD website (<http://mdaqmd.ca.gov/>) to keep the public informed of current conditions. For those without computer access, the District also provides a phone number to call for air quality forecasts. A copy of the health advisory the District issued for November 13-14, 2006, promptly notifying the public, is attached to this document.

Provide for Public Education on How to Minimize Exposure

The District has an active community outreach program, as well as easily accessible information on their website to aid in public education on the hazards posed by exceptional events and how to minimize exposure to particulate matter.

Summary

The District request, for the PM10 TEOM concentrations at Victorville on November 14, 2006, to be excluded as due to a natural event caused by dust entrained by high winds, is reasonable and appropriate. The rise in PM10 concentrations at the Victorville site, accompanied as it was by increased wind speed, a shift in wind direction, and upper-level atmospheric support, indicate a clear and causal connection between the entrained dust and the exceedance at the monitor. Further analysis of historical and

background levels, as well as local emissions, indicates that ‘but-for’ the high wind, there would not have been an exceedance at the Victorville monitor.

Attachments

Health Advisory issued by District
Newspaper articles noting high winds in the Mojave Desert

Resources

Bush, David. *T&B Systems Contribution to CRPAQS Initial Data Analysis of Field Program Measurements, Final Report Contract 2002-06PM*. Technical & Business Systems, Inc., November 9, 2004
<http://www.arb.ca.gov/airways/CRPAQS/DA/Final/TBFinalOverview.pdf>

California Air Resources Board (CARB). *California Surface Wind Climatology*, June 1984

California Air Resources Board (CARB). Air Quality and Meteorological Information System (AQMIS2), <http://www.arb.ca.gov/aqmis2/aqinfo.php>, 2008, 2009

California Air Resources Board (CARB). Emissions Inventory Data:
<http://www.arb.ca.gov/ei/emissiondata.htm>, 2009

ENVIRON, *Wind Blown Dust Study*, 2004

Federal Register (72 FR 13560-13581). *Treatment of Data Influenced by Exceptional Events; Final Rule*. Vol. 72, No. 55, Pages 13560-13581, March 22, 2007.

Federal Register (73 FR 14687-14713). *Approval and Promulgation of Implementation Plans; Designation of Areas for Air Quality Planning Purposes; State of California; PM-10; Affirmation of Determination of Attainment for the San Joaquin Valley Nonattainment Areas*. Vol. 73, No. 54, Pages 14687-14713, March 19, 2008.

Google Maps. <http://maps.google.com>. 2008

Mojave Desert Air Quality Management District (District). *Rule 403, Fugitive Dust Control for the Mojave Desert Planning Area*, 1996

Mojave Desert Air Quality Management District (District). *California Environmental Quality Act (CEQA) and Federal Conformity Guidelines*, June 2007

Mojave Desert Air Quality Management District (District). *Natural Event Documentation (NED)*, June 28, 2007; September 28, 2007; and March 3, 2008

Mojave Desert Air Quality Management District (District). Website,
<http://mdaqmd.ca.gov/>, 2008

National Oceanic and Atmospheric Administration (NOAA). Air Resources Laboratory,
Hybrid Single Particle Lagrangian Integrated Trajectory Model (Hysplit):
<http://www.arl.noaa.gov/HYSPLIT.php>, 2008

San Francisco State University, Department of Geosciences, California Regional
Weather Server: http://squall.sfsu.edu/crws/archive/sathts_arch.html, 2008

United States Environmental Protection Agency (U.S. EPA), Neil Frank, Presenting
Evidence to Justify Data Exclusion as an Exceptional Event, Presentation to Westar
State/EPA Exceptional Events Implementation Meeting, February 25-26, 2009

ATTACHMENTS

1. Health Advisory issued from Mojave Desert AQMD
2. News Clippings from local newspapers – online archives



**Mojave Desert Air Quality Management District
Community Relations & Education Office
14306 Park Avenue
Victorville, CA 92392**

NOTICE OF HEALTH ADVISORY

****HAZARDOUS****

PAGE ONE OF ONE

ADVISORY DATE: November 13, 2006

EFFECTIVE DATE: November 14, 2006 TIME: **Until Midnight**

For further information, contact:

Violette Roberts, Community Relations & Education Manager

(760) 245-1661, ext. 6104 or Eldon Heaston, Executive Officer (760) 245-1661, ext. 5538

Due to the current high wind situation, local communities may experience elevated levels of particulate matter in outdoor air. Therefore, the Mojave Desert Air Quality Management District (MDAQMD) recommends that individuals affected take the following precautions throughout the entire **Mojave Desert AQMD** jurisdiction (any areas nearby and surrounding these cities – Adelanto, Apple Valley, Barstow, Hesperia, Lucerne Valley, Needles, Phelan, Trona, Twentynine Palms, and Yucca Valley).

- **EVERYONE** should avoid outdoor exertion. If you must be outdoors please take the following precautions.
- Individuals with respiratory disease, such as asthma, should avoid moderate or heavy exertion. Everyone else, especially children and the elderly should avoid prolonged exertion.
- Stay indoors if possible. Keep doors and windows closed when possible and set air conditioners on the "recycled air" setting, if units are equipped with this option (i.e., close the outdoor air vent)
- Office building managers are advised to set ventilation/air conditioning systems to minimize outdoor air entering structures (remember to re-set system once the episode is over).
- Outdoor workers are advised to minimize prolonged outdoor exertion.
- Individuals experiencing breathing difficulties or chest pain are advised to see their physician.

For updated information, call the MDAQMD's automated Air Quality Forecast Line at (760) 245-1661, ext. 5067 or the Community Relations & Education Office at (760) 245-1661, ext. 6717. Or visit our website at www.mdaqmd.ca.gov for more health precautions and the latest air quality information updates as made available.

Wind stirs dust and safety hazards.

Source: 📰 Daily Press (Victorville, CA)

Publication Date: 15-NOV-06

Byline: Hillary Borrud

Nov. 15--VICTOR VALLEY -- The wind brought more than tumbleweeds through the valley on Tuesday, with gusts and dust possibly a factor in two traffic collisions and a wildfire.

Twelve vehicles piled up in two collisions on Highway 18, east of Rabbit Springs Road, as wind whipped up dust to the point of zero visibility Tuesday morning, according to California Highway Patrol Officer Mike Kerr. One person involved sustained minor injuries.

Wind also blew over power lines in Wrightwood, according to spokeswoman Dee Dechert of the U.S. Forest Service, where a wildfire started at about 4 a.m. and burned about six acres of vegetation. The cause of the fire is under investigation.

The fire did not cause any injuries or home damage, Dechert said. It was contained at about 8 a.m., the Associated Press reported.

"This is the time of year we get the Santa Anas, and almost any front that comes through will be strong enough to produce high winds," said forecaster Robert Balfour of the National Weather Service in San Diego.

The peak wind gust in Victorville was 41 mph at 11 a.m. Tuesday. Meanwhile, high winds in Johnson Valley reached 72 mph, Balfour said. The wind should die down in upcoming days, he said. Strong winds usually begin in mid-October and continue through December.

The vehicles involved in the two traffic collisions on Highway 18 were traveling eastbound at about 9 a.m. Tuesday morning, with a group of eight vehicles followed by a second string of three cars and a Victor Valley Transit Authority bus.

"Our vehicle was rear-ended as other vehicles were slowing," said Robert Mendoza, a general manager for Veolia Transportation, which contracts with VVTA.

The collisions are under investigation by California Highway Patrol.

Dispatch Supervisor Tom Barnes of the San Bernardino County Fire Department said Tuesday afternoon that the weather did not cause any other major incidents.

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